

**PRINCIPLES OF GENE MANIPULATION (PGM), BIOL417**  
Fall, 2010

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Office: 316 La Kretz Hall  
Hrs: Drop-in for students in classes  
T 8:30-9:30 AM  
W 4:15-4:45 PM  
By appointment in BIOL Office for advisement  
W 4:45-6:15 PM

**Prerequisites:** 1) General Genetics or Microbial Genetics AND 2) Cell Biology or Biochemistry (or their equivalents from another university)

**Final Examination:** Wednesday, December 8, 8 -10:30 AM

PGM WebPage: link from <http://www.calstatela.edu/faculty/ssharp>  
Password: \_\_\_\_\_

**Required Textbook:** T.A. Brown, **Gene Cloning & DNA Analysis, An Introduction**. Sixth edition. Wiley-Blackwell, 2010.

Reading list (see below); articles available online.

**Study Aid, on reserve:** Sample Problems

**Required materials:** Two bluebooks for quizzes

### GOALS FOR THE COURSE

1. To gain an understanding of the concepts of gene manipulation and its applications by achieving the objectives for each of the ten weeks.
2. To become familiar with the use of some of the database search tools of bioinformatics.
3. To introduce yourselves and each other to the breadth of career opportunities in biotechnology via student PowerPoint presentations, presented as posters.

### READING LIST / TIMELINE OF COURSE

All listed items are available online on the class website via password.

The reading list below details the readings **not** found in your textbook. A list of objectives for each week is available online. Each objective is followed by relevant readings from the textbook, and where applicable, by sample problems to use as a study aide. The sample problems are available at the reserve desk in the library. One copy can be checked out directly from me at the end of any class period and must be returned by the beginning of the next class period.

Repeat: **Textbook reading assignments are found in the weekly lists of objectives and are not listed below. Important exam and assignment due dates are found in Class Policies, 2010.**

**Friday, September 24: *Introduction***

**Week 1. What's gene manipulation and why should I care? Restriction endonuclease basics.**  
(9/27) **Self-review.**

- Week 2.** How do you construct a cDNA clone? Gel electrophoresis basics.  
(10/4)
- Week 3.** Gel blot hybridization. Probe labeling, hybridization, visualization.  
(10/11)
- Week 4.** What are recombinant DNA libraries? Colony/plaque hybridization. Subcloning. Refinements of blot hybridization analysis.  
(10/18)
- Week 5.** A wide range of vectors for your cloning and subcloning pleasure!  
(10/25) **Midterm**
- Week 6.** Expression systems for research and profit  
(11/1) \_\_\_\_\_
- Schmidt, F.R., "Recombinant expression systems in the pharmaceutical industry," Applied Microbiology and Biotechnology (2004) 65:363-372.
- Week 7.** Study of gene and genome structure. Sequencing. PCR, DNA fingerprinting. Mapping. How do you find a gene about which you know almost nothing?  
(11/8) \_\_\_\_\_
- Chakravarti, A., "Single nucleotide polymorphisms . . . to a future of genetic medicine." (2001) **Nature** 409:822-823.
  - What are genome-wide association studies? <http://www.genome.gov/20019523>
  - White, R. and J.-M. Lalouel, "Chromosome Mapping with DNA Markers." **Scientific American**, February, 1988, pp. 40-48.
- Week 8.** Ways to study promoters and their role in regulation of gene expression. ChIP. Reporter assays. In vitro mutagenesis  
(11/15)
- Week 9.** Stable gene transfer into animals (and plants). What's a knock-in? a knock-out? A knockdown? (Includes Thanksgiving)  
(11/22) \_\_\_\_\_
- Capecchi, Mario R., "Altering the Genome by Homologous Recombination," **Science** (1989), v. 244, 1288-1292.
  - [http://www.rnaiweb.com/RNAi/What\\_is\\_RNAi/](http://www.rnaiweb.com/RNAi/What_is_RNAi/)
  - Aagaard L, Rossi JJ. "RNAi therapeutics: principles, prospects and challenges." 2007. **Adv Drug Deliv Rev.** 59:75-86.
- Week 10.** Genome-wide Studies: Microarray; RNA-Seq; ChIPSeq (11/24)  
(11/29) \_\_\_\_\_
- Perkel J. SNP genotyping: Six technologies that keyed a revolution. 2008. **Nature Methods** 5:447-453.
  - Wold B and Myers RM. "Sequence census methods for functional genomics." (2008) **Nature Methods** 5:19-21.

Please do us all a favor and bring to class or office hours any relevant current reading material you find!

## CLASS POLICIES, PGM 2010

### I. Important dates

Questionnaire with personal certification of prerequisites due

On or before Wed, September 29, 9:50 AM

**Failure to certify honestly passing completion of prerequisites can result in your being dropped from the class.**

Homework

10/1; 10/8; 10/15; 10/22

Midterm

Wed, 10/27

Midterm Recovery

TBA; ~3 weeks after the midterm

PowerPoint Career Assignment

Monday, 11/22 and Friday, 12/3

Final Exam

Wednesday, Dec. 8, 8-10:30 AM

### II. Grades

Midterm, 35%; PowerPoint Career Assignment, 15%; Comprehensive final, 35%; Homework, quizzes, and class participation, 15%.

90-100% = A; 80-89% = B; 65-79% = C; 50-64% = D. +/- grades will be given within these ranges. The highest grade achieved on an exam is taken to be 100%. So, if the highest grade were 92, and you earned 83, your % would be  $83/92 \times 100 = 90\%$  and you would be working at the equivalent of "A-". Use the grading sheet to help you keep track.

### III. Homework and quizzes

Homework due dates are listed above and will be announced in class. **Homework is due at the beginning of the period. You should prepare both an original and a readable copy of your work.** You will turn in the original at the beginning of class. We may work with the copy during class, and you will then turn it in at the end of the period. An overall homework, quizzes, and participation grade will be given based on the completeness and care evident in your homework. Quizzes will be given daily at 9:50 AM, will cover material from the last period's lecture, and will last for only four minutes. You should have two bluebooks in which to write your quiz answers. Take advantage of time, study partners, email, and office hours to study your notes, objectives, and practice problems, and to complete your homework well.

### IV. Exams

Exams will be short answer, essay, and problems. You may be asked to draw and label an answer. To earn a "C," you must know the facts. To earn an "A," you must be able to work with the facts. **One or more of the practice problems will be on the exams** (see below)!

### V. Term Career Assignment (PowerPoint)

Teams of two will be responsible for presenting the important points of one of many possible career choices in biotechnology. The careers will be assigned more or less randomly. The purposes of this assignment are 1) to increase your awareness of career options and 2) to give you practice using PowerPoint. Your PowerPoint presentations will be presented in simple poster format on the last day of class so that all of you can learn more about all of the careers. Details will be made available on a separate handout.

### VI. Academic Honesty

The University's Academic Honesty Policy is located at

<http://www.calstatela.edu/academic/senate/handbook/ch5a.htm>.

Students are expected to read the policy. Violators will be subject to disciplinary action, and may receive a failing grade in the course for a single violation.

### VII. Use of computers

You will need email, the Internet, software such as Microsoft Word and PowerPoint, and access to a printer. To access campus computing facilities and the academic information network, you must have a **Network Information Services (NIS) Account**. (It's free.) Students can apply for or obtain their Network/Email account information by going to the ITS Help Desk located in the Library Palmer Wing (LIB PW) Lobby. A current CSULA ID or a valid photo ID and proof of enrollment (i.e. GET enrolled class schedule printout, or other official class listing) are required to receive a Network/Email account. The account will be ready for pick-up after one (1) business day. Photo identification must be presented before the account can be issued. If you are a Continuing Education, Open University, or late admitted student, you must complete an

application at the ITS Help Desk. Continuing Education and Open University students may use the receipt for payment of class registration fees as proof of registration and must have a picture ID.

## **CLASS POLICIES** (cont'd.)

### **VIII. Missed exams or assignments**

There will be no make-up exams. Late assignments will not be accepted. A missed exam or late assignment will receive no credit. An exception will be made for a graduate or professional school interview, hospitalization, or other excuse that can be verified in writing and confirmed by telephone. With a verifiable excuse – the final grade will be duplicated for the missed midterm, and a missed final will be assigned an incomplete.

### **IX. Studying**

You are expected to read in advance, as assigned, from the text and the reading list. Articles in the reading list are available online. You will also need to study and practice. **Remember, for any college class the expectation is at least 2 hours study outside of class for every 1 hour in.** Make good use of:

- 1) Lists of objectives and other assignments.
- 2) Sample problems (see below). These will be available on reserve in the library. Answers to many of the problems are available with the problems. If after attempting to solve a problem, you and your study group do not see how to arrive at the correct answer, be sure to come to office hours or use email to describe your problem. Supply evidence of your attempts to solve the problem.
- 3) The margins or face pages of your notes. Use your notes to study on a regular basis. During class, you may wish to take notes on only the front side of the paper. The back or facing side can then be used to: make marks during lecture when you don't understand something, write out questions which occur to you as you review your notes, make notes during study which explain lecture notes, etc.
- 4) Office hours. These are for you to use when you, or you and your study group, have given your best effort to grasping the material, and you are still not satisfied. Being prepared for office hours optimizes what you gain from your visit!
- 5) email. Use email to ask questions and check your email for a response. If your question is of general interest to the class, the answer may be posted on the class WEB page or emailed to the entire class. Check the WEB page frequently.
- 6) Your study group. It is strongly urged that you meet at least weekly for review and self-testing.

### **X. Sample Problems**

The sample problems are taken from five different textbooks, and seven different chapters. The books and chapters are listed below. These problems have been xeroxed, assigned a Roman Numeral, put together in a three ring binder, and placed on reserve in the library (3copies), and in my office (2). The office copies will be available for check-out immediately after class or during office hours. The Roman Numerals below match those used to designate the chapters in the binders on reserve. Each chapter is divided into two sections: Q, for questions and A, for answers. Both sections have the same divider tab color. Those problems that relate to a specific objective are noted on your Objectives handouts. To be able to solve some of the problems, you will need command of several of the objectives.

Please take good care of the reserve copies. You may wish to remove sheets from the binder in order to xerox them yourself. This is OK. Just be sure to double check that you have replaced them all and that they are in the correct order and in the correct location. THANK YOU!

- I. **Student Companion for MOLECULAR CELL BIOLOGY** by Rintoul, Welti, Storrie, and Lederman. 3rd. edition. Scientific American Books. 1995.  
Chapter 7, pp. 79-88 (questions) and 89-96 (answers).
- II. **GENETIC ANALYSIS** by Suzuki, Griffiths, Miller, and Lewontin. Freeman. 1989.  
pp. 437-442 (questions) and 752(answers). Note: This entry starts with a few solved problems. The sample questions begin on page 438.
- III. **MOLECULAR BIOLOGY OF THE CELL, The Problems Book** by Wilson and Hunt. Garland Press. 1994.  
Chapter 7, pp. 27-45 (questions) and 299-310 (answers).
- IV. **BIOCHEMISTRY--A PROBLEMS APPROACH** by Wood, Wilson, Benbow, and Hood. 2nd edition.  
Benjamin/Cummings. 1991. pp. 387-395 (quest.) and 396-402 (answers).
- V. **Student Companion for MOLECULAR CELL BIOLOGY** by Rintoul, Welti, Storrie, and Lederman. 3rd. edition. Scientific American Books. 1995.  
Chapter 8, pp. 97-107 (questions) and 108-118 (answers).
- VI. **GENETICS. Analysis of Genes and Genomes** by Hartl and Jones. Jones and Bartlett. 2000. Chapter 2,  
pp 78-84 (questions) and 786-787 (answers).

VII. **GENETICS. Analysis of Genes and Genomes** by Hartl and Jones. Jones and Bartlett. 2000. Chapter 13, pp 583-588 (questions) and 797-798 (answers).